

Research Essay Draft 1

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I live in a huge scary sphere filled with plastics- pliable and easily shaped oil and coal - (as I like to call them). It does sound scary when you read it out loud and trust me when I say, “it looks scarier than it sounds.” These “pliable and easy shaped oil and coal” are one of the causes of the world’s most intimidating issues. One of such issues is air pollution, which according to the World Health Organization (WHO) is estimated “to cause about 29% of lung cancer deaths, 43% of COPD deaths, about 25% of ischaemic heart disease deaths, and 24% of stroke deaths” globally. In addition, the major air pollution sources reported by WHO include: “residential energy for cooking fueled by kerosene and coal, vehicles, power generation, agriculture/waste incineration, industry, and fossil waste.” Nonetheless, most government institutions have put together laws to reduce, if not eliminate, some sources of air pollution like vehicles, power generation, and agriculture/waste incineration. This leaves fossil waste, either from households or industries, as the most active and scariest source of air pollution. Similarly, Popular and reliable Environmental News, Data Analysis, Research, and Policy Solutions websites like earth.org confirm fossil fuel as one of the major causes of air pollution.

Many factors like industries, vehicles, electricity, and plastic wastes contribute to the increase of fossil pollution. Although industries account for the largest amount of fossil fuel waste produced (through the burning of fossils), plastic waste is rapidly becoming one of, if not, the largest fossil fuel source. Thus, as more plastics are produced, fossil fuel pollution increases. According to the UN environment programme, “If historic growth trends continue, global

primary plastic pollution is forecasted to reach 1,100 million tonnes by 2050.” Also, through personal observation, from over 7 countries I’ve visited, I can with no doubt confirm the rapid increase in plastic waste pollution over the years. Although my observations are not reliable a source, I still take great interest in plastic waste pollution because of the rapid increase predicted by the UN and other reliable sources. However, my interest in plastic waste is mainly piqued by the question, “why is there a predicted increase in plastic waste when there are many possibly effective solutions that are being implemented and in innovation?” Thus, I fail to understand why there’s a predicted increase instead of a decrease considering all the amazing solutions to plastic pollution.

In this paper, I hope to highlight some reasons behind the ineffectiveness of existing solutions to plastic pollution; analyze a new solution – plastic-eating bacteria – and the reasons I believe in its effectiveness to solve the issue of plastic pollution; and finally, suggest an even “absurd-er” idea of ways I believe the effectiveness of the absurd idea, plastic-eating bacteria, can be maximized to effectively, if not completely, eliminate plastic pollution considering plastic pollution is a major issue the world faces today.

I always wondered how “pliable and easily shaped oil and coal” are harmful to the environment and its inhabitant aside from stripping the environment of its colorful and bright beauty; and good smell. But after reading numerous articles on lung and heart cancer, I chanced on all the harmful effects these non-living invaders cause to both human health and the environment. As enlightening and baffling as that was, I was more surprised to see all the advocacy, organizations, laws, and other potential solution that were in place to curb plastic pollution. My surprise resulted because plastic pollution appears to be increasing rapidly with no solutions to prevent the increase rather than decreasing as a result of possibly effective solutions

available. For instance, in 2017, United Nations Environmental Programme launched the “Clean Seas campaign aimed to fight against marine litter and plastic pollution.” Nonetheless, from 2016 to 2040, the United Nations Environmental Programme predicted in an article, “Our planet is choking on plastic,” the estimated increase in plastic waste in water bodies from 9-14 million tonnes per year to 23-35 million tonnes per year. Although this data is limited to plastic waste entering water bodies, it still proves the ineffectiveness and, accounts for the skepticism towards the potential of the campaign as a viable solution to plastic waste.

In contrast, I believe campaigns are viable solutions to the issue of plastic waste because they inform its participants, other stakeholders, and the general public about the harmful effect of and the ways to curb plastic pollution. Nonetheless, I believe the execution of the campaign, resulted in its ineffectiveness. A more effective approach would have been to engage the world in the activity by creating a competition or trend for the campaign. That would have been more effective in getting more people to participate in the campaign and produced better results. Engaging campaigns that tend to take advantage of social media, awards, competition, and other engaging approaches can effectively fight against air pollution by empowering more people to reduce plastic waste.

Similarly, a solution like recycling, which is with no doubt a possible effective solution, seems to be very ineffective considering the predicted rise. Recycling is the method of reusing waste materials. In the case of plastic waste, it refers to the process of using your plastic materials more than once. Unfortunately, both producers and customers these days appreciate plastics produced for single-used purposes. “Around the world, one million plastic bottles are purchased every minute, while up to five trillion plastic bags are used worldwide every year. In total, half of all plastic produced is designed for single-use purposes – used just once and then

thrown away,” United Nations (UN) informs. This reduces the effectiveness of recycling. Also, like campaigns, the engagement between the solution and the general public is close to nonexistent considering the number of people required to participate in order for plastic pollution to be resolved. Recycling, when done properly by engaging the public and creating reusable plastic products, can effectively curb the issue of air pollution

Similar to campaigns and recycling, there are numerous potentially effective methods (currently active or in the making) that could be used to curb plastic pollution. One of such methods, although might sound “absurd” is Plastic Eating Bacteria.

Although this is an amazing idea, I believe if its execution is done the way it’s planned, or the way the previous solutions were executed, it will only be as successful as the previous solutions. Hence, I propose an even “absurd-er” idea of executing the plastic-eating bacteria solution in creation. I propose laws to be created to ensure that for every plastic you buy a sufficient number of plastic-eating bacteria should be sold alongside your plastic. This ensures plastics bought are metabolized by users if not recycled. This approach hinges on the concept of “engagement” either through social media, competitions, and other engaging approaches.

The idea of making plastic-eating bacteria as well as making plastic-eating bacteria for domestic use, sets off a series of questions and objections. But through thorough research I can, with no doubt, say that the idea is one of the most effective solutions to plastic pollution which will result in a predicted reduction in plastic waste pollution.

A major initial question is the possibility of the existence of “plastic-eating bacteria.” In reply, yes! Not only is there a possibility of the existence of such bacteria but also there have been sightings of them and successful experimentation with them. According to the articles,

“The Race to Develop Plastic-Eating Bacteria,” and “A bacterium that degrades and assimilates polyethylene terephthalate,” on forbes.com, and Science.com respectively, in 2016 scientists from Japan discovered the bacteria: *Ideonella sakaiensis*. They discovered the bacteria’s ability to eat a specific plastic called Poly (ethylene terephthalate) (PET), from which 97.1 percent of plastics are made. For skeptics interested in the biology of the finding, similar research was conducted by a team of environmental biologists and published in an article, “450-driven plastic-degrading synthetic bacteria. *Trends in Biotechnology*, 40(2), 166–179.” In the article, the writer said, “Plastic biodegradation by microorganisms is a notable possible solution. This opinion article includes a proposal to use hypothetical P450 enzymes with an engineered active site as potent trigger biocatalysts to biodegrade polyethylene (PE) via in-chain hydroxylation into smaller products of linear aliphatic alcohols and alkanolic acids based on cascade enzymatic reactions.” This explains in biological terms, the possible chain reaction that needs to occur for plastic-eating bacteria to degrade polyethylene (PE). These researches not only prove the possibility of the existence of plastic-eating bacteria but also provides hope for humans in the fight against plastics.

Another significant skeptic and criticism of the idea of creating plastic-eating bacteria for domestic use is, the health risks posed by releasing genetically modified bacteria into the environment. Not only was this a concern to me but also, other people invested in the topic. Wolfgang Zimmerman, a scientist at the University of Leipzig, alarmed a concerned about the risk involved in the idea of plastic-eating bacteria when he said, “Since most likely genetically engineered microorganisms would be needed, they cannot be released uncontrolled into the environment.” Following these concerns, researchers and scientists work round the clock to ensure the safety and effectiveness of plastic-eating bacteria. Consequently, some scientists from

the University of Portsmouth created an enzyme ‘cocktail’. According to an article, “NEW ENZYME COCKTAIL DIGESTS PLASTIC WASTE SIX TIMES FASTER,” by the University of Portsmouth, “A second enzyme, found in the same rubbish dwelling bacterium that lives on a diet of plastic bottles, has been combined with PETase to speed up the breakdown of plastics into smaller monomers.” In more technical terms, the Journal, “Characterization, and engineering of a two-enzyme system for plastics depolymerization,” reports the process as the combination of PETase- a digestive enzyme found in plastic-eating bacteria, and METHase, “to convert the polymer into soluble intermediates and to produce the constituent PET monomers respectively.” These end product, PET monomers specifically terephthalic acid, was further analyzed and broken down into edible vanillin, an essential constituent of vanilla. The breakthrough of this experiment does not only ensure the safety of genetically engineered plastic-eating bacteria but also helps reduce the use of fossils to produce vanilla. Although more research is required to make the idea of plastic-eating bacteria ultimately safe, the research shows the progress scientists have made in ensuring the safety of genetically engineered plastic-eating bacteria on humans and the environment.

Similarly, the research on producing a “cocktail enzyme” does not only provide a solution to the health risk plastic-eating bacteria pose but also, improves the effectiveness of the plastic-eating bacteria. Another major concern and challenge the idea of creating plastic-eating bacteria for domestic use faces is producing a sufficient number of plastic-eating bacteria for mass use. In regards to that, the scientist claims the creation of the cocktail enzyme makes the bacteria degrading plastic six times faster. The rate of increase in the degrading of plastic is a promising solution to the question of mass production because a fewer number of bacteria is required for the same amount of plastic waste.

Plastic eating bacteria, although effective a method, if executed “wrongly” will be as effective as most of the current solutions to eliminating plastic waste. Nonetheless, implementing a law that forcefully encourages users to degrade their plastic after use will be an effective way to ensure the maximum effectiveness of plastic-eating bacteria. Plastic-eating bacteria should be sold alongside plastics making them accessible and effective. Data from an article by the UN highlight, “approximately 85 percent of single-use plastics end up in landfills or as unregulated waste.” I believe public engagement, specifically instant degrading of plastic by its user, is an effective method because, in place of collecting waste material for mass processing, which eventually ends up in landfills or as unregulated waste, single-use plastic users can instantly degrade plastics to form useful substances like vanillin. Analyzing the data from the UN above, this solution is expected to reduce the single used plastic pollution by 85 percent.

Creating laws that require plastic users to degrade their plastic immediately after use with plastic-eating bacteria is no doubt, a very effective way of ensuring engagement. Nonetheless, I believe that promoting the idea and the law over social media will increase the success of engagement with the idea of plastic-eating bacteria. Studies, according to [statista.com](https://www.statista.com), show that over 3.6 billion people engage in activities on social media. The solution of plastic-eating bacteria could be turned into a global competition of “who can produce the most terephthalic acid (the monomers that can be broken down into vanillin).” Activities like competitions will increase the engagement of people with the laws governing plastic-eating bacteria and ultimately, maximize the effectiveness of the solution: plastic-eating bacteria.

In conclusion, this research suggests an idea (creating plastic-eating bacteria for domestic use), although absurd, to solve the issue of plastic pollution, air pollution, and ultimately environmental pollution by analyzing how closely related and dependent those issues are. The

research study and its results provide enlightening awareness of plastic waste pollution and solutions to fight against it. While I described the world to be scary, this study provides captivating ideas and solutions to the issue of evacuating most, if not all, “pliable and easily shaped oil and coal.” Although existing solutions seemed to be nonexistent or ineffective due to the predicted increase in plastic pollution, these solutions’ effectiveness could be maximized through thorough engagement as seen in the case of recycling, campaigns, and most importantly plastic-eating bacteria. The promising results of this study change my view of the world being “a huge scary sphere,” and suggest that the world could be safe. Although the solution- plastic-eating bacteria- is possible and seems effective, there’s still much to learn about plastic-eating bacteria and plastic waste pollution.

CITATION

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